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(54) **ELEVATOR GOVERNOR HAVING TWO TRIPPING MECHANISMS ON SEPARATE SHEAVES**

(75) Inventor: **Randall S. Dube**, Glastonbury, CT (US)

(73) Assignee: **Otis Elevator Company**, Farmington, CT (US)

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(56) **References Cited**

U.S. PATENT DOCUMENTS

1,977,452 A 10/1934 Neuschotz
3,695,396 A 10/1972 Jones

(Continued)

FOREIGN PATENT DOCUMENTS

EP 2243739 A2 10/2010
JP 8002848 A 1/1996

(Continued)

OTHER PUBLICATIONS

Chinese Search Report for Application No. 2011800669091 dated Jan. 26, 2015.

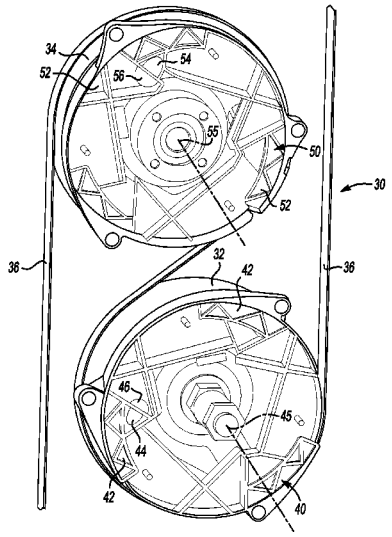
(Continued)

Primary Examiner — Anthony Salata
(74) *Attorney, Agent, or Firm* — Carlson, Gaskey & Olds

(57) **ABSTRACT**

An exemplary elevator system includes an elevator car. A first governor sheave is supported on the elevator car for movement with the elevator car. The first governor sheave is supported for rotational movement relative to the elevator car responsive to movement of the elevator car. A first governor tripping mechanism is supported on the first governor sheave. The first governor tripping mechanism provides an indication to perform a first governor function for controlling the speed of the elevator car responsive to the elevator car moving at a speed above a first threshold speed. A second governor sheave is supported on the elevator car for movement with the elevator car and for rotational movement relative to the elevator car responsive to movement of the elevator car. A second governor tripping mechanism is supported on the second governor sheave. The second governor tripping mechanism provides an indication to perform a second governor function for controlling a speed of the elevator car responsive to the elevator car moving at a speed above a second threshold speed.

20 Claims, 2 Drawing Sheets



(56) **References Cited**

U.S. PATENT DOCUMENTS

4,083,432	A	4/1978	Lusti	
4,977,982	A	12/1990	Bialy et al.	
5,052,523	A	10/1991	Ericson	
5,299,661	A *	4/1994	Pramanik	B66B 5/044 187/373
5,310,022	A	5/1994	Sheridan et al.	
5,407,028	A *	4/1995	Jamieson	B66B 5/10 187/287
5,487,450	A	1/1996	Gerber	
5,513,723	A	5/1996	Luebke	
5,797,472	A	8/1998	Kamani et al.	
6,170,614	B1 *	1/2001	Herkel	B66B 1/32 187/287
6,360,847	B1 *	3/2002	Okada	B66B 5/044 187/373
6,454,054	B1	9/2002	Tanino et al.	
6,564,907	B1	5/2003	Sasaki	
6,691,834	B2	2/2004	Sanchez et al.	
6,752,246	B2	6/2004	Takai et al.	
6,988,593	B2	1/2006	Sanchez et al.	
7,014,014	B2 *	3/2006	Mueller	B66B 5/06 187/288
7,475,756	B2	1/2009	Maury et al.	
7,537,090	B2	5/2009	Vantanen	
7,575,099	B2	8/2009	Oh et al.	
7,607,516	B2	10/2009	Simon et al.	
8,069,956	B2 *	12/2011	Okada	B66B 5/044 187/287
8,342,294	B2	1/2013	Madoz Michaus et al.	
2004/0134726	A1	7/2004	Sanchez et al.	
2008/0245617	A1	10/2008	Madoz Michaus et al.	
2009/0014256	A1 *	1/2009	Matsuoka	B66B 5/0018 187/393
2012/0103732	A1 *	5/2012	Kwon	B66B 5/044 187/305
2013/0220739	A1 *	8/2013	Okada	B66B 5/04 187/254
2014/0367206	A1 *	12/2014	Della Porta	B66B 5/06 187/305
2015/0083528	A1 *	3/2015	Kattainen	B66B 5/0031 187/393
2015/0136544	A1 *	5/2015	Dube	B66B 5/044 188/180

FOREIGN PATENT DOCUMENTS

JP	2009154984	A	7/2007
WO	03055780	A1	7/2003
WO	2006070436		7/2006
WO	2008079106	A1	7/2008

OTHER PUBLICATIONS

International Preliminary Report on Patentability for International application No. PCT/US2011/023890 dated Aug. 22, 2013.
International Search Report and Written Opinion of the International Searching Authority for International application No. PCT/US2011/023890 dated Nov. 18, 2011.

* cited by examiner

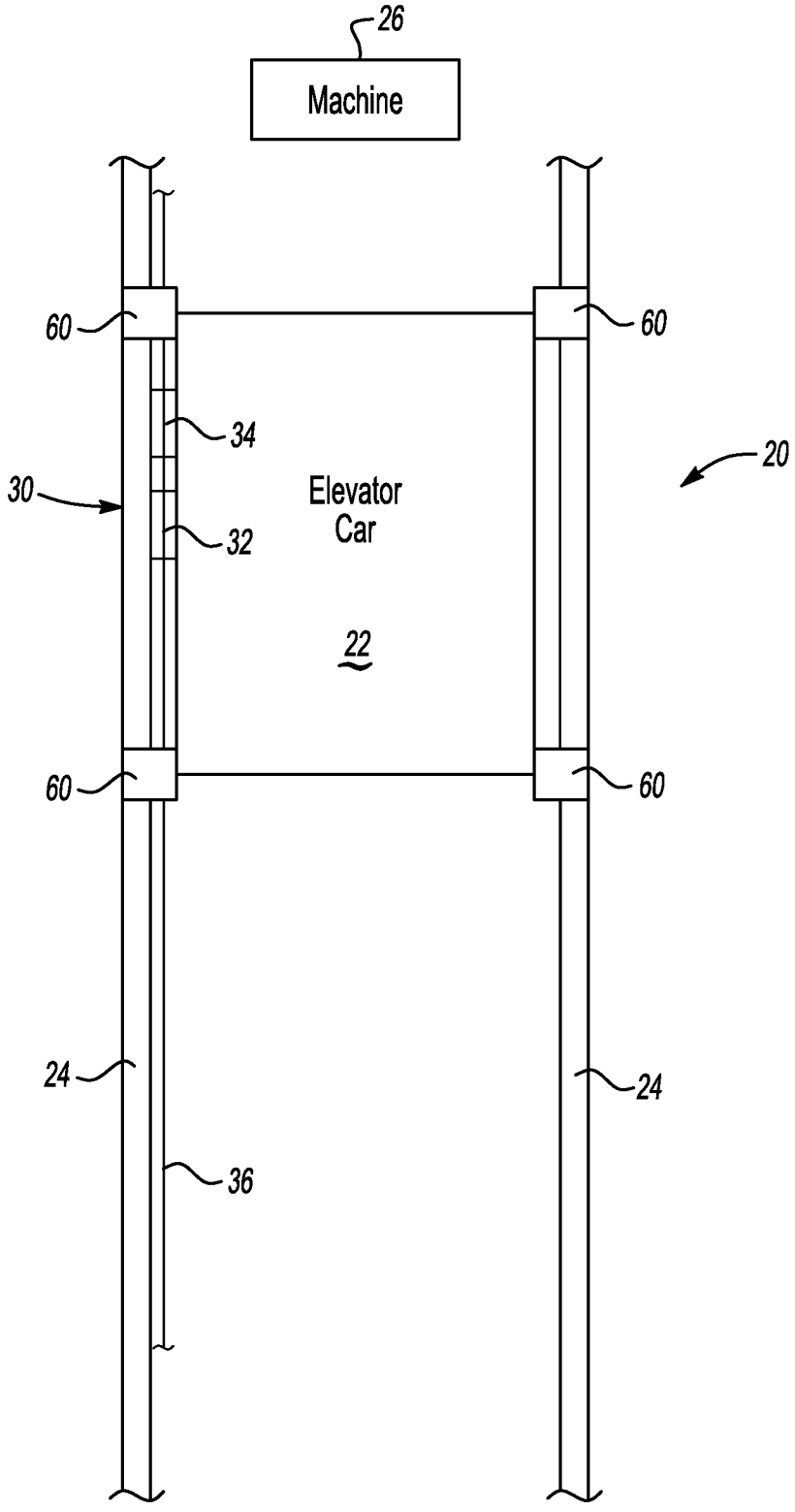


Fig-1

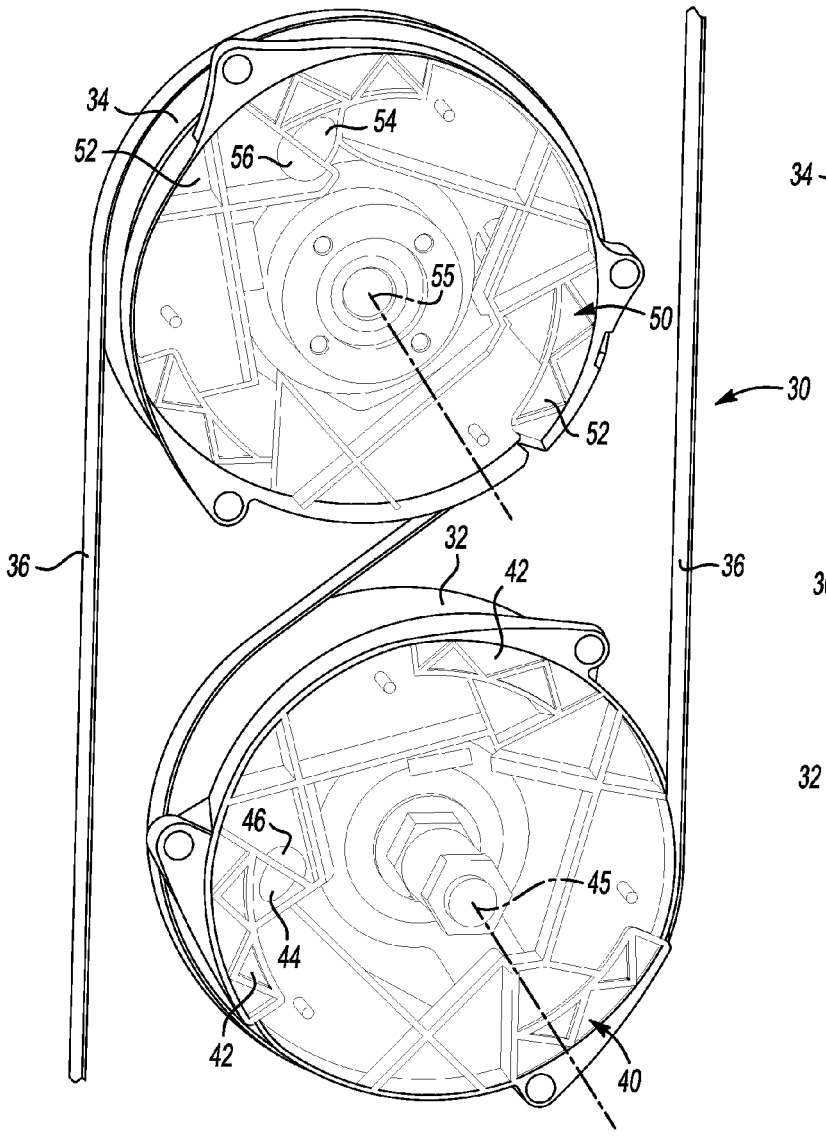


Fig-2

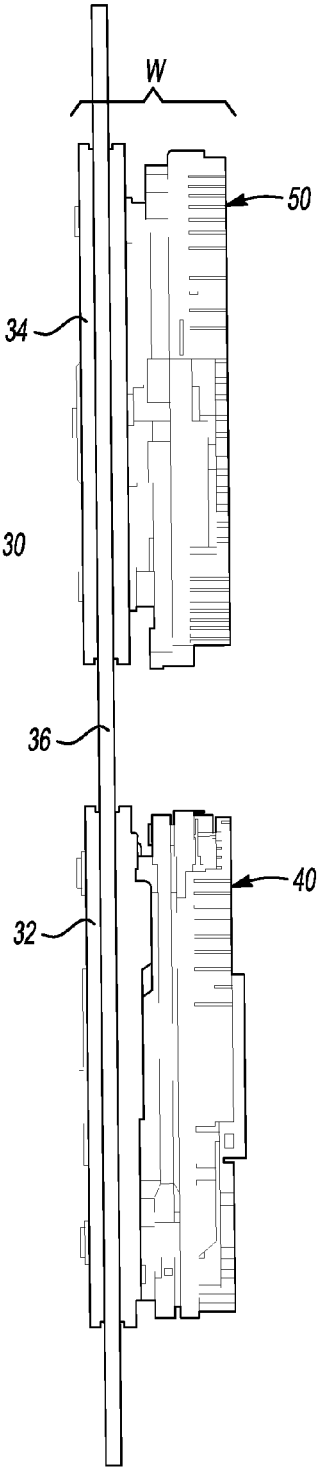


Fig-3

ELEVATOR GOVERNOR HAVING TWO TRIPPING MECHANISMS ON SEPARATE SHEAVES

BACKGROUND

Elevator systems include a variety of devices for providing control over movement of the elevator car. Elevator governors for protecting against over speed conditions are well known. Most elevator governors include a tripping mechanism located near the top of the hoistway. A governor rope extends along the length of the hoistway wrapping around a governor sheave associated with the tripping mechanism and an idler sheave associated with a tension weight near an opposite end of the hoistway. The elevator car is connected with the rope so that the rope moves as the elevator car moves. If the elevator car moves at a speed that is higher than desired, the speed of rotation of the governor sheave activates the tripping mechanism.

Governors in elevators systems are used for two purposes. One use of an elevator governor is for activating or dropping the machine brake and interrupting power to the machine motor in the event of an over speed condition. The other use is for activating elevator safeties that engage the guide rails, for example, in the event of a further over speed condition. Given that the governor reaction to each over speed condition is not independent, it is difficult to achieve specific control over the speed at which the governor performs both functions. Additionally, relying upon a single governor tripping mechanism for both functions introduces additional challenges when satisfying some codes for low speed elevators.

SUMMARY

An exemplary elevator system includes an elevator car. A first governor sheave is supported on the elevator car for movement with the elevator car. The first governor sheave is supported for rotational movement relative to the elevator car responsive to movement of the elevator car. A first governor tripping mechanism is supported on the first governor sheave. The first governor tripping mechanism provides an indication to perform a first governor function for controlling the speed of the elevator car responsive to the elevator car moving at a speed above a first threshold speed. A second governor sheave is supported on the elevator car for movement with the elevator car and for rotational movement relative to the elevator car responsive to movement of the elevator car. A second governor tripping mechanism is supported on the second governor sheave. The second governor tripping mechanism provides an indication to perform a second, different governor function for controlling movement of the elevator car responsive to the elevator car moving at a speed above a second threshold speed.

An exemplary method for controlling movement of an elevator car includes providing an indication from a first governor tripping mechanism to perform a first governor function for controlling a speed of the elevator car responsive to the elevator car moving at a speed above a first threshold speed. The first governor tripping mechanism is supported on a first governor sheave that is supported on the elevator car. A second tripping mechanism is supported on a second governor sheave that is also supported on the elevator car. An indication from the second governor tripping mechanism is provided to perform a second, different governor function for controlling movement of the elevator car responsive to the elevator car moving at a speed above a second threshold speed.

The separate governor tripping mechanisms each supported on its own governor sheave provides specific control over the tripping mechanism reaction at a desired, corresponding threshold speed. The separate tripping mechanisms on their own governor sheaves also provides more flexibility and a more reliable arrangement compared to using a single tripping mechanism to perform both functions.

The various features and advantages of this invention will become apparent to those skilled in the art from the following detailed description. The drawings that accompany the detailed description can be briefly described as follows.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** schematically illustrates selected portions of an example elevator system designed according to an embodiment of this invention.

FIG. **2** diagrammatically illustrates one example governor arrangement designed according to an embodiment of this invention.

FIG. **3** is a side view of the arrangement shown in FIG. **2**.

DETAILED DESCRIPTION

FIG. **1** schematically shows selected portions of an elevator system **20**. An elevator car **22** is supported in a known manner for movement along guide rails **24**. An elevator machine **26** includes a motor and brake for controlling movement of the elevator car **22** in a generally known manner.

A governor assembly **30** is provided for protecting against over speed conditions in which the elevator car **22** moves at a speed that is higher than a desired speed. The governor assembly **30** includes a first governor sheave **32** supported on the elevator car **22** for movement with the elevator car **22** as it moves along the guide rails **24**. The first governor sheave **32** rotates relative to the elevator car **22** as the car **22** moves along the guide rails **24**. A second governor sheave **34** is also supported on the elevator car **22** and is rotatable relative to the elevator car **22**. A governor rope **36** has ends that remain near ends of the hoistway, for example, in which the elevator car **22** is situated. In one example, an upper end is fixed and a lower end is attached to a hanging mass to maintain a desired tension on the governor rope **36**. The hanging mass is situated to allow for limited, guided vertical movement in some examples. The governor rope **36** at least partially wraps around each of the governor sheaves **32** and **34** so that each sheave rotates as the elevator car **22** moves relative to the governor rope **36**.

FIG. **2** diagrammatically illustrates an example arrangement of the governor assembly **30**. A first governor tripping mechanism **40** is supported on the first governor sheave **32**. A plurality of centrifugal elements **42** rotate with the first governor sheave **32** as the elevator car **22** moves. The centrifugal elements **42** are maintained in an inactivated position by biasing members **44**. When the speed of rotation of the first governor sheave **32** exceeds a selected first threshold, the centrifugal force exerted on elements **42** overcomes the force of the biasing members **44** and the elements **42** move at least partially in a radially outward direction relative to an axis of rotation **45** of the first governor sheave **32**. When the centrifugal elements **42** move outwardly, they interact with an actuator mechanism (not illustrated) that works in a known manner to perform a first governor function. In one example, the first governor function is to cause activation (e.g., dropping) of the machine brake **26** for slowing down movement of the elevator car **22** and interrupting power to the machine motor. In

another example the first governor function is to control a speed of movement of the elevator car **22** in either an upward or a downward direction.

In this example, the biasing member **44** comprises a magnet that cooperates with a magnetic portion **46** for maintaining the centrifugal elements **42** in a first inactivated position (illustrated in FIG. **2**, for example) relative to the first governor sheave **32** whenever the first governor sheave **32** rotates at a speed below the first threshold speed. When the speed of the elevator car **22** exceeds the first threshold, the corresponding speed of rotation of the first governor sheave **32** and centrifugal force on the elements **42** overcomes the magnetic force of attraction between the magnet **44** and the magnetic portion **46**, such that the centrifugal elements **42** move outward to provide an indication to perform the first governor function.

Although the illustrated examples include magnetic biasing members, other embodiments include different biasing members such as springs.

The second governor sheave **34** supports a second governor tripping mechanism **50** that includes centrifugal elements **52**. A biasing member **54**, which is a magnet in this example, biases the centrifugal elements **52** into a retracted position (shown in FIG. **2**) as the governor sheave **34** rotates about an axis of rotation **55**. When the speed of the elevator car **22** exceeds a selected second threshold, the corresponding speed of rotation of the second governor sheave **34** and centrifugal force on the elements **52** overcomes the biasing force of the biasing member **54**, and the centrifugal elements **52** move in a radially outward direction relative to the axis **55**. Under such conditions, the second governor tripping mechanism **50** provides an indication to perform a second governor function. In one example the second governor function is to activate supplemental brakes such as elevator safeties **60** (generally shown in FIG. **1**) provided on the elevator car **22**. The elevator safeties **60** in this example engage the guiderail **24** to cause the elevator car **22** to stop in a known manner. Another example second governor function is to control elevator car movement in a direction opposite to that associated with the first governor function.

In an illustrative example, the biasing member **54** comprises a magnet that cooperates with a magnetic portion **56** for maintaining the centrifugal elements **52** in a first position relative to the second governor sheave **34** at speeds below the second threshold speed.

The illustrated governor assembly **30** includes separate governor sheaves **32** and **34** and separate governor tripping mechanisms **40** and **50** to provide separate, independent control over the two distinct governor functions. This independent control over each function increases the accuracy with which each function is performed. The independent mechanisms also provide greater flexibility for addressing a variety of situations.

For example, it is possible to independently control the first threshold speed at which the machine brake is dropped (and power to the machine motor is interrupted) and the second, higher threshold speed at which supplemental brakes such as the elevator safeties **60** are engaged. The first threshold speed and second threshold speed can be selected to meet the needs of a particular situation. The separate governor sheaves **32** and **34** and the corresponding separate tripping mechanisms provide precise control over the activation provided by each tripping mechanism to separately address the different over speed conditions associated with the two different threshold speeds. Such an arrangement is superior to a governor assembly that relies upon a single tripping mechanism to provide activation of the machine brake and a supplemental brake, for example, at different threshold speeds.

In one example, each tripping mechanism is dedicated to controlling elevator speed in a specific direction. The first governor sheave **32** and its first tripping mechanism **40** are used for controlling upward movement of the elevator car **22**. The second tripping mechanism **50** in such an example is used for controlling a speed of downward movement of the elevator car **22**. Having two independently activated tripping mechanisms provides the ability to select different threshold speeds for the respective directions.

The example of FIG. **2** includes the governor rope **36** at least partially wrapping around each of the governor sheaves **32** and **34**. In this example, the angle of wrap around each governor sheave is at least 240° to provide reliable engagement between the governor rope **36** and each of the governor sheaves **32** and **34**, respectively. In this example, the first governor sheave **32** rotates in one direction and the second governor sheave **34** rotates in an opposite direction.

The tripping mechanisms **40** and **50** can comprise the same components. The force exerted by the second biasing member **54** in some examples is greater than the force exerted by the first biasing member **44**, so that the second tripping mechanism **50** provides an indication for activating the supplemental brake at a higher speed compared to that at which the first tripping mechanism **40** provides an indication to activate the machine brake **26** (and interrupt power to the motor). In one example, a stronger magnet is used for the biasing member **54** of the second tripping mechanism **50** compared to that biasing member **44** used for the first tripping mechanism **40**. In another example, the centrifugal elements **52** of the second tripping mechanism **50** are configured differently than the centrifugal elements **42** of the first tripping mechanism **40**. For example, different weights may be used to alter the speeds at which the tripping mechanisms provide their respective indications. Different weight allows for all centrifugal elements and magnets to be the same and have different tripping speeds. Those skilled in the art who have the benefit of this description will realize how to configure two tripping mechanisms to realize two separate threshold speeds at which each provides an indication for performing a corresponding governor function.

One feature of the illustrated example is that the governor sheaves **32** and **34** rotate about separate axes **45** and **55**, respectively. That arrangement combined with the profile of the tripping mechanisms **40** and **50** allows for realizing a relatively narrow governor assembly **30** having a width w shown in FIG. **3**. Given that the governor assembly **30** is mounted onto an elevator car **22**, it is desirable to fit that within the small space constraints of a typical hoistway. The illustrated example allows for positioning the governor assembly **30** on the elevator car **22** so that it readily fits between a side of the elevator car **22** and a hoistway wall adjacent that side.

The preceding description is exemplary rather than limiting in nature. Variations and modifications to the disclosed examples may become apparent to those skilled in the art that do not necessarily depart from the essence of this invention. The scope of legal protection given to this invention can only be determined by studying the following claims.

I claim:

1. An elevator system, comprising:

an elevator car;

a first governor sheave supported on the elevator car for movement with the elevator car and for rotational movement relative to the elevator car responsive to movement of the elevator car;

a first governor tripping mechanism supported on the first governor sheave that provides an indication to perform a

first governor function to control movement of the elevator car responsive to the elevator car moving at a speed above a first threshold speed;

a second governor sheave supported on the elevator car for movement with the elevator and for rotational movement relative to the elevator car responsive to movement of the elevator car;

a second governor tripping mechanism supported on the second governor sheave that provides an indication to perform a second governor function to control movement of the elevator car responsive to the elevator car moving at a speed above a second threshold speed.

2. The elevator system of claim **1**, wherein the first and second governor tripping mechanisms comprise centrifugal elements that are biased into a first position relative to the corresponding governor sheave, the centrifugal elements moving outward toward a second position responsive to movement of the elevator car near the corresponding threshold speed.

3. The elevator system of claim **2**, wherein the centrifugal elements of the first governor tripping mechanism are configured to move out of the first position at a first sheave rotation speed and the centrifugal elements of the second governor tripping mechanism are configured to move out of the first position at a second, higher sheave rotation speed.

4. The elevator system of claim **3**, comprising weights secured to the centrifugal elements and wherein the weights of the first governor tripping mechanism are different than the weights of the second governor tripping mechanism.

5. The elevator system of claim **3**, wherein a biasing member that biases the centrifugal elements of the first governor tripping mechanism exerts a lower biasing force than a biasing member of the second governor tripping mechanism.

6. The elevator system of claim **5**, wherein the biasing member of each governor tripping mechanism comprises a magnet and a magnetic force of the magnet of the first governor tripping mechanism is lower than a magnetic force of the magnet of the second governor tripping mechanism.

7. The elevator system of claim **1**, comprising a governor rope that remains essentially fixed relative to the elevator car, each of the governor sheaves engaging the governor rope and rotating relative to the governor rope as the elevator car moves.

8. The elevator system of claim **7**, wherein

the governor rope wraps at least partially around each of the governor sheaves,

the first governor sheave rotates in a first direction and

the second governor sheave rotates in a second, opposite direction.

9. The elevator system of claim **1**, wherein the first governor function comprises activating a machine brake for reducing a speed of the elevator car and the second governor function comprises activating a supplemental brake for stopping the elevator car.

10. The elevator system of claim **1**, wherein the first governor function comprises controlling a speed of elevator car movement in a first direction and the second governor function comprises controlling a speed of elevator car movement in a second, opposite direction.

11. A method for controlling movement of an elevator car having first and second governors supported on the elevator car for movement with the elevator car and for rotational movement relative to the elevator car responsive to movement of the elevator car and first and second governor tripping mechanisms each supported on one of the governor sheaves, comprising the steps of:

providing an indication from the first governor tripping mechanism to perform a first governor function for controlling a speed of the elevator car responsive to the elevator car moving at a speed above a first threshold speed; and

providing an indication from the second governor tripping mechanism to perform a second governor function for controlling speed of the elevator car responsive to the elevator car moving at a speed above a second threshold speed.

12. The method of claim **11**, wherein the first and second governor tripping mechanisms comprise centrifugal elements that are biased into a first position relative to the corresponding governor sheave, the centrifugal elements moving outward toward a second position responsive to movement of the elevator car near the corresponding threshold speed.

13. The method of claim **12**, wherein the centrifugal elements of the first governor tripping mechanism are configured to move out of the first position at a first sheave rotation speed and the centrifugal elements of the second governor tripping mechanism are configured to move out of the first position at a second, higher sheave rotation speed.

14. The method of claim **13**, wherein each centrifugal element includes at least one weight and the weights of the first governor tripping mechanism are different than the weights of the second governor tripping mechanism.

15. The method of claim **13**, wherein a biasing member that biases the centrifugal elements of the first governor tripping mechanism exerts a lower biasing force than a biasing member of the second governor tripping mechanism.

16. The method of claim **15**, wherein the biasing member of each governor tripping mechanism comprises a magnet and a magnetic force of the magnet of the first governor tripping mechanism is lower than a magnetic force of the magnet of the second governor tripping mechanism.

17. The method of claim **11**, comprising

providing a governor rope having remains essentially fixed relative to the elevator car; and

engaging the governor rope with the governor sheaves such that the governor sheaves rotate relative to the governor rope as the elevator car moves.

18. The method of claim **17**, comprising

rotating the first governor sheave in a first direction and

rotating the second governor sheave in a second, opposite direction.

19. The method of claim **11**, wherein the first governor function comprises activating a machine brake for reducing a speed of the elevator car and the second governor function comprises activating a supplemental brake for stopping the elevator car.

20. The method of claim **11**, wherein the first governor function comprises controlling a speed of elevator car movement in a first direction and the second governor function comprises controlling a speed of elevator car movement in a second, opposite direction.

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